The effect of prestimulation on milking characteristics during machine milking of goat

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Summary

Goat milking is optimal if maximum milk yield is obtained in minimum time frame. Prestimulation influences milk yield and other milking characteristics. The aim of this study was to determine optimal milking characteristics for different times spent on prestimulation during machine milking of goats. Prestimulation of 30 s was optimal to achieve maximum milk yield and flow in the shortest time. Longer milking interval resulted in higher milk yield, milk flow, but also in the longest milking time. Milking goats in 4th parity had higher average and peak flow rate, while goats in third parity had longer milking time, with higher milk yield. The results of this study show that prestimulation time longer than 30 s is not necessary to obtain optimum milking characteristics during machine milking of goats.

Key words: machine milking, prestimulation, oxytocin, milking characteristics

Introduction

Goat milking main goal is to obtain the maximum amount of milk in the shortest amount of time avoiding blind milking. Before the milking starts there are two milking fractions present in the udder of the goat: cisternal and alveolar. The cisternal milk fraction is stored in the gland and teat cistern and the alveolar milk fraction is stored in small milk ducts and alveoli (Bruckmaier and Blum, 1998.) Milking characteristics are not influenced with the udder morphology during machine milking in Murciano-Granadina goats (Peris et al., 1999).

Prestimulation before the milking starts elicits a neurohormonal reflex which results in milk ejection. Basal concentration of oxytocine before prestimulation occur range from 2.3 to 4.1 pg/mL (Mosdøl et al., 1981). After prestimulation, oxytocine concentration rapidly increases already after 30 s in goats

(Bruckmaier et al., 1994). Cisternal and teat gland size increases already after 10 to 15 s after i.v. oxytocine injection and lasts for another 10 to 15 s when maximum cistern size is obtained (Bruckmaier and Blum, 1992). This increase is larger in cistern than in teat gland. After the start of prestimulation fast oxytocine relase with subsequent milk ejection is not important while cisternal milk fraction in Alpine goats is 75 % of the total milk yield from the udder (Marnet and McKusick, 2001). There is a great variation in oxytocine release between goat breeds during the machine milking (Mosdøl et al., 1981). Quality of milk secretion can be measured through milking characteristics during machine milking of goat (Marnet and McKusick, 2001). There are no investigation about the effect of prestimulation shorter than 1 min on milking characteristics during machine milking of the goat. The aim of this investigation was to test the hypothesis that prestimulation

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is important to obtain optimal milking characteristics during machine milking of the goat.

Materials and methods

The experiment was performed on 21 Alpine goat in their third and fourth lactation from commercial farm "Hercigonja" in Donja Podgora, Croatia, in the milking parlour for 10 goats. Milking machine had following characteristics: pulsation rate 90 and milking vacuum 38 kPa. During the milking goats were fed with concentrate. Prestimulation consisted of the following routine: teat desinfection, forestripping and teat drying. Stripping was performed and milking unit was pulled down in cow direction when the milk flow dropped below 100 g/min. Experimental milking routine consisted of three routines: prestimulation in a duration of 1 min, 30 s and no prestimulation. Milking interval between morning and evening milking was 10 h and between evening and morning milking 14 h. During machine milking following milking characteristics were measured: peak and average flow rate, milk yield, milking time and stripping yield. Milking characteristics were measured with *Lactocorder©* (WMB, Balgach, Switzerland). In the experiment change-over experimental plan was used with following three prestimulation treatments (0 s, 30 s and 60 s within 6 experimental days). Treatments were allocated randomly and treatments were changed every two days.

Statistical analysis

Milking characteristics were analyzed with the following model:

$$y_{ijkl} = \mu + \tau_i + \beta_k + SUB(\beta)_{jk} + t_l + p_m + s_n + \varepsilon_{ijklmn}$$

where:

y_{ijkl} = observation on subject (animal) j with treatment i, allocation of the treatments k and period l

μ = overall mean

t_i = treatment effect $i=1$ to 3

β_k = effect of treatment day allocation $k = 1$ do 2

$SUB(\beta)_{jk}$ = random effect of the goat (subject) $j=1$ to 21 within day k with mean 0 and variance σ^2

t_l = the effect of day of lactation $l = 2$, 3 and 4

p_m = the effect of milking interval $m = $ *morning and evening*

s_n = the effect of number of lactation $n = 3$ and 4

ε_{ijklmn} = random error with mean 0 and variance s^2

Pairwise differences between treatment means were tested by using the Tukey-Kramer test with multiple comparison adjustment. The analyses were performed by using MIXED procedure of SAS program (SAS Institute, 2004).

Table 1: Means and standard errors of the mean for milking characteristics in different treatments
Tablica 1: Prosjeci i standardne greške muznih karakteristika za različite tretmane

Milking characteristics Muzne karakteristike	Treatment Tretman (s)			Standard error of the mean Standardna greška
	0	30	60	
Peak flow rate Najveći protok mlijeka (kg/min)	0.60[a]	0.68[b]	0.65[ab]	0.02
Average flow rate Prosječni protok mlijeka (kg/min)	0.36[a]	0.48[b]	0.41[ab]	0.03
Milk yield Količina mlijeka (kg)	0.69	0.71	0.68	0.02
Milking time Vrijeme mužnje (min)	2.15[a]	1.98[b]	2.00[ab]	0.07
Stripping Izmuzivanje (kg/min)	0.13[a]	0.09[b]	0.09[b]	0.01

[a, b] - means with different superscript differ (P<0.05)
[a, b] - prosjeci s različitim superskriptom se razlikuju (P<0,05)

Results and discussion

During experiment 251 milk flow curve was measured. Milk yield did not changed throughout the prestimulation treatments (Table 1), while stripping yield was significantly higher (P<0.05) in goats without compared to goats with prestimulation. Average and peak flow rate had highest values and milking time was shortest during machine milking with 30 s prestimulation (Table 1). It was already shown that during 30 s prestimulation after the start of milking oxytocine concentration rises above 20 ng/L what is sufficient to obtain alveolar milk fraction (Bruckmaier et al., 1994).

Average flow rate during 30 s prestimulation was similar to value obtained in experiment from Ilahi et al. (1999), in amount of 0.49 kg/min for Alpine breed. Similar results for stripping yield, after the milk flow drops below 100 g/min. In treatment without prestimulation (0.09±0.01) and 1 min prestimulation (0.10±0.01) for the same lactation period, was obtained by Bruckmaier et al. (1994). Positive effect of 30 s prestimulation on shortening milking time and increase of average and peak flow rate is similar as in cows (Mayer et al., 1984). Milk yield was significantly higher (P<0.05) in goats in third (0.78±0.03 kg/milking) than in 4th (0.61±0.03 kg/milking) lactation. Milk yield was higher in third than in 4th lactation in Murciano-Granadina goat breed (Peris et al., 1996). Higher milk

yield was obtained during morning (after interval of 14 h; 0.80±0.02 kg/milking) than evening milking (after interval of 10h; 0.58 ± 0.02 kg/milking). The difference of 40 % in the amount of milk yield was found during milking interval of 9 and 15 h by Bruckmaier et al. (1994).

Decrease in milk yield with increase of number of lactation was shown in Murciano-Granadina goat breed with two milkings per day (Salama et al., 2003). In table 2 was shown that average and peak flow rate was higher in goats in 4th than in third lactation. Number of lactation and prestimulation duration interaction was not significantly different, although numericaly better milking characteristics were obtained in goats with that without prestimulation. Third lactation goats had higher milk yeild and longer milking time with lower average and peak flow rate (Table 2). Ilahi et al. (1999) show that peak flow rate was highest in second lactation goats. Their values for the third and 4th lactation goats were similar to our results, although they were somewhat higher in the same stadium of lactation (0.9 kg/min). Goats in their 4th lactation shortly after the start of milking increase milk flow up to the peak and therefore they have higher volume of the cisternal part of the udder (Bruckmaier et al., 1994).

Morning milking interval was longer (14 h) compared to evening (10 h) and therefore higher values for peak and average flow rates were obtained during morning milking (see table 3). Moreover milk yield

Table 2: Means and standard errors of the mean for milking characteristics in different lactation numbers
Tablica 2: Prosjeci i standardne greške muznih karakteristika za različite laktacije

Milking characteristics Muzne karakteristike	Lactation number Laktacija		Standard error of the mean Standardna greška
	3	4	
Peak flow rate Najveći protok mlijeka (kg/min)	0.59	0.70	0.03
Average flow rate Prosječni protok mlijeka (kg/min)	0.36[a]	0.55[b]	0.03
Milk yield Količina mlijeka (kg)	0.78[a]	0.60[b]	0.02
Milking time Vrijeme mužnje (min)	2.48[a]	1.61[b]	0.10
Stripping Izmuzivanje (kg/min)	0.11	0.10	0.01

[a, b] - means with different superscript differ (P<0.05)
[a, b] - prosjeci s različitim superskriptom se razlikuju (P<0,05)

Table 3: Means and standard errors of the mean for milking characteristics in different milking intervals
Tablica 3: Prosjeci i standardne greške muznih karakteristika za intervale između mužnji

Milking characteristics Muzne karakteristike	Milking interval Interval između mužnji		Standard error of the mean Standardna greška
	14 h	10 h	
Peak flow rate Najveći protok mlijeka (kg/min)	0.70^a	0.60^b	0.02
Average flow rate Prosječni protok mlijeka (kg/min)	0.50^a	0.41^b	0.02
Milk yield Količina mlijeka (kg)	0.80^a	0.58^b	0.02
Milking time Vrijeme mužnje (min)	2.21	1.88	0.06
Stripping Izmuzivanje (kg/min)	0.11	0.10	0.01

[a, b] - means with different superscript differ (P<0.05)
[a, b] - prosjeci s različitim superskriptom se razlikuju (P<0,05)

was also higher during morning than during evening milking so we conclude that there is a dependance between average and peak flow rate and milk yield. Mosdøl et al., (1981) showed dependance between milk yield and intramammary pressure. The higher the intrammamary pressure, especially in the udder with smaller cistern, the milk flow is higher and on contrary, the higher the cistern, the intramammary pressure increase is lower. However, cisternal milk fraction is sufficient, especially in this early stage of lactation that there is no interruption of the milk flow and that peak flow rate is obtained shortly after the start of milking.

Conclusions

Results of this study show that Alpine goat breed is well adapted to machine milking. Prestimulation of 30 s resulted in highest average and peak flow rate, shortest milking time, numerically highest milk yield and lowest stripping yield when the milk flow dropped below 100 g/min. Longer milking interval resulted in higher milk yield, average and peak flow rate, while milking time was longer. Average and peak flow rate was higher in 4th lactation goats, while third lactation goats had longer milking time and higher milk yield. Prestimulation of 30 s resulted in best milking characteristics, therefore longer prestimulation (1 min) is not necessary.

Utjecaj predstimulacije na muzne karakteristike pri strojnoj mužnji koza

Sažetak

Strojna mužnja koza predstavlja izmuzivanje maksimalne količine mlijeka u što kraćem vremenu. Predstimulacija, utječe na ukupnu količinu mlijeka, te na ostale muzne karakteristike. Cilj ovog rada je utvrditi optimalne muzne karakteristike primjenom različitih dužina trajanja predstimulacije tijekom strojne mužnje koza pasmine alpina. Predstimulacija u trajanju od 30 sekundi rezultirala je mužnjom sa najvećom količinom i protokom mlijeka u najkraćem vremenu. Duži interval između mužnji rezultirao je većom količinom pomuzenog mlijeka, najvećim protokom, ali i najdužim trajanjem strojne mužnje koza. Koze četvrte laktacije su imale veći prosječni i najveći protok mlijeka, dok su koze treće laktacije imale duže trajanje strojne mužnje, te veću količinu pomuzenog mlijeka. Rezultati ovog istraživanja pokazuju da predstimulacijom u trajanju od 30 sekundi se postižu optimalne muzne karakteristike tijekom strojne mužnje koza pasmine alpina.

Ključne riječi: strojna mužnja, predstimulacija, oksitocin, muzne karakteristike

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